formity at site 209 (Burns *et al* 1973). It is probably valid to consider this reflector as being associated with silicification and thus as an Eocene time-line wherever it occurs. This reflector abuts unconformably against basement on the Marion Plateau, local highs on the Queensland Plateau and basement of the higher parts of the Dampier Ridge. It is hypothesised therefore that these areas were emergent during this period of siliceous deposition.

Tectonic Evolution

The regional history can be summarised as follows: Opening of the southern Tasman Sea commenced at about Anomaly 36 time (6o m.y.) about a pole located at 6° S, 146° E. This opening extended northwards into the Middleton Basin moving the Lord Howe Rise away from Australia and the Dampier Ridge. Possibly at the same time, the New Caledonia Basin opened about the same pole, moving the Norfolk Ridge eastward. This opening was linked by a transform fault to a spreading axis at an unknown locality in the New Hebrides Basin. At around Anomaly 29 time (69 m.y.), spreading in the Tasman-Middleton Basin jumped westward into the north Tasman Basin and Cato Trough moving the Dampier Ridge and Kenn-Chesterfield Plateau away from Australia. This same spreading system may have separated the Louisiade Rise from the Queensland Plateau area. At around 65 m.y., as opening around the Tasman pole was drawing to an end, opening commenced in the Coral Sea Basin with the axis orientated in a more westerly direction. This opening moved the Louisiade Rise further north, and was probably superimposed upon the Tasman Sea opening in the Mellish Rise arc. The Rennel and Louisiade Fracture Zones, activated by Tasman opening were further activated by Coral Sea opening and spreading continued into the New Hebrides Basin.

Tasman opening ceased around 60 m.y. and Coral Sea opening continued at least into the early Eocene by which time the continental fragments in the region commenced to subside.

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THE RELATIONSHIP BETWEEN STRUCTURES ON THE SOUTHEAST AUSTRALIAN MARGIN AND IN THE TASMAN SEA

J. Ringis

Geological Survey of New South Wales, Sydney

A study of the magnetic anomaly pattern in the Tasman Sea has shown that it opened by a process of sea floor spreading between about 80 and 60 my.b.p. (Hayes and Ringis, 1973). The spreading pattern appears to have been quite complex. The basin is disected by many fracture zones (transform faults) and there appears to have been considerable variation in spreading rates within blocks bounded by these fracture zones. This is clearly shown by the varying widths of crustal blocks generated in periods of 5 m.y., as shown in Figure 1. Further, the trend of the magnetic pattern, and hence crustal isochrons, intersects the trend of the southeast Australian margin at an angle of about 45° to 50° . As a result, progressively older oceanic crust is absent north of Bass Strait.

Based on this and on seismic profiles which show the presence of a basement trough adjacent to the margin, Hayes and Ringis (1973) postulated the existence of a subduction zone which would have operated for a limited period of about 6 to 7 m.y. during Tasman Sea opening. This postulate is further supported by the presence along the southeast Australian margin of many of the features adduced by Inman and Nordstrom (1971) as typical of collision coasts. These include first order characteristics such as the relatively straight and mountainous coast, a narrow continental shelf and steep slope, and the presence of the postulated residual trench offshore.

Wilson (1965) proposed that lines of old crustal weakness on the continental block determine the site of transform faults when sea floor spreading commences. Fuller (1971) showed that this appears to be the case for South Atlantic fracture Zones, which can be related to lines of old crustal weakness in southern Africa.

The present study of major structural features along the south-eastern Australian margin was undertaken to determine if a similar relationship also exists between south-eastern Australia and the Tasman Sea. The results are presented in Table 1.

The above summary clearly shows that many of the major structural features in southeastern Australia intersect the coast at or near the extension of Tasman Sea fracture zones. Several discordant igneous intrustive masses on the coast or shelf also occur along fracture zone trends. All of these features predate Tasman Sea opening, in some cases by more than 200 m.y., and all are indicative of the existence of zones of weakness in the crust. There are no clearly defined fracture zones in this part of the Tasman Sea which are not associated with such zones of weakness.

It therefore appears that the development and location of fracture zones in this part of the Tasman Sea was determined by the location of pre-existing zones of weakness in the pre-drift continental crust.

If this relationship is valid for the whole of the Tasman Sea, then it should be possible to predict the possible location of fracture zones in those parts of it where a good

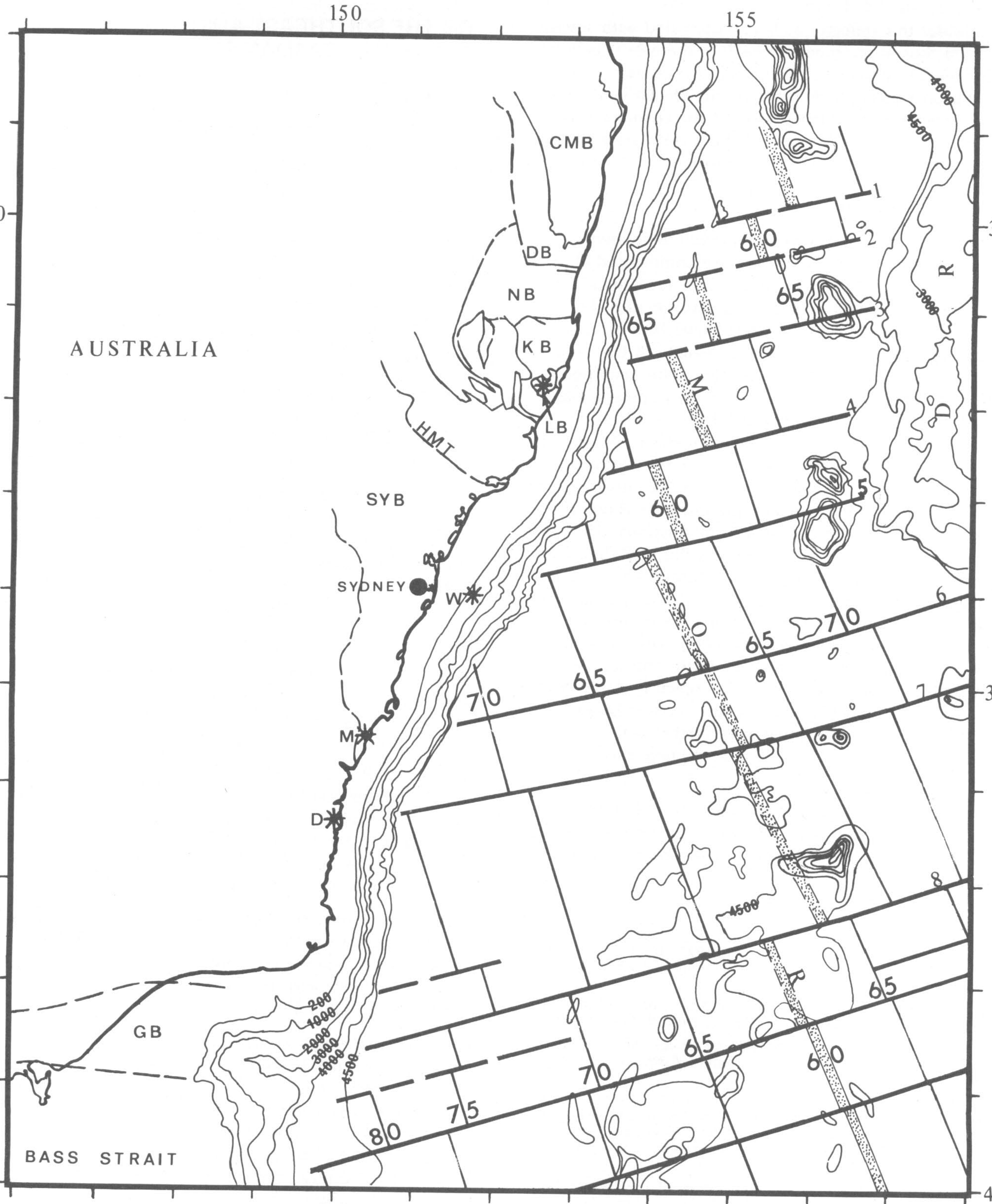

Figure 1.

Major Structural Features of Southeastern Australia and The Tasman Sea.

CMB — Clarence-Moreton Basin; DB — Demon Block; NB — Nambucca Block; KB — Kempsey Block; LB — Lorne Basin; HMT — Hunter-Mooki Thrust; SYB — Sydney Basin; W — Mt Woolnough; M — Milton Intrusives; D — Dromedary Intrusives; GB — Gippsland Basin; MOR — Mid Ocean Ridge; DR — Dampier Ridge.

Fracture Zones 1 to 8 numbered on right.

Age of Tasman Sea crust shown by isochron lines paralleling MOR. Bathymetry by Ringis and Hayes (1972), in corrected metres.

Fracture Zone, Number and Name	Features on Margin along Fracture Zone Trend
1. Coffs Harbour	South edge of Demon Block (Devonian), north edge of Nambucca Block (Permian) Crossmaglen and other parallel east-west faults intersect coast. Pillow lavas and adamellites occur between the faults. Bathymetric indentation of margin approximately between fracture zones No. 1 and No. 2. This may be the offshore morphologic expression of the Permian Nambucca Block. Location of fracture zone No. 1 not precisely determined by magnetic pattern.
2. Trial Bay	South edge of Nambucca Block, north edge of Kempsey Block (Carboniferous). Permian adamellite bodies occur on the coast. Indentation of bathymetric contours approximately here.
3. Port Macquarie	South edge of Port Macquarie Block, north edge of Lorne Basin (Triassic). Discordant igneous bodies occur onshore; radiometrically dated at 194±6 m.y. (Geol. Surv. N.S.W., unpublished data). Serpentine belt intersects coast.
4. Hunter	Hunter-Mooki thrust zone (Permian) intersects coast. Northern edge of Permo-Triassic Sydney Basin.
5. Woolnough	Mt Woolnough, an inferred basic igneous intrustive body (Hartman, 1965), occurs on upper slops. Approximate east-west fault along extension of fracture zone on shelf (Bembrick *et.al.,* 1973).
6. Milton	Milton igneous complex occurs on coast dated at about 240 m.y. (Mayne *et.al.,* 1974). Near southern edge of Sydney Basin. Possible bathymetric offset of margin.
7. Dromedary	Mt Dromedary igneous complex occurs on coast; dated at 94 m.y. (Evernden and Richards, 1962). Change in trend of margin.
8. Bass	Bathymetric contours of Bass Strait offset by about 60 to 70 km. South edge of Gippsland Basin (Jurassic to Tertiary) (Weeks and Hopkins, 1967).
NOTE: Onshore geological data used in this compilation were obtained from the Tweed Heads, Maclean, Coffs Harbour, Hastings, Newcastle, Sydney, Wollongong, Ulladulla, Bega and Mallacoota 1:250,000 Geological Series Sheets and from the 1:1,000,000 Tectonic Map of New South Wales, published by the Geological Survey of New South Wales, as well as from the references cited.	

TABLE 1
Relationship Between Tasman Sea Fracture Zones and Structural Features on the Southeast Australian Margin.

knowledge of the geology of the marginal continental blocks is available. In particular, this may assist to elucidate the structure of the northern part of the Tasman Sea, where its narrow width and the presence of the Tasmantid seamount chain has precluded an unambiguous identification of magnetic lineations.

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